AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A machine-implemented method of simulating~~, in a machine,~~ a string, the method comprising:

simulating a force acting on the string by a stream of a fluid medium flowing in a direction that has a component along a longitudinal axis of the string;

~~using~~ forming a wave equation that relates movement of the string in time to the force acting on the string; and

generating a sound based on the movement described in the wave equation~~, wherein the force acting on the string simulates a stream of a fluid medium flowing relative to the string~~.

2. (Original) A method according to claim 1, wherein:

the simulated string is supported between two supports and is aligned at rest in a first direction between the two supports;

a first of the two supports allows movement in a second direction orthogonal to the first direction and a second of the two supports does not allow movement; and

the string is caused from rest to vibrate in a plane, which includes the first and second directions, by turbulence in the fluid flow causing the stream of fluid medium to exert a pressure on the string in the second direction.

3. (Currently Amended) A method according to claim 2, wherein:

movement of the string out of alignment with the first direction causes the stream of fluid medium flowing in the first direction to exert ~~a~~ the force on the string in the second direction.

4. (Original) A method according to claim 1, wherein:

the simulated string is supported between two supports aligned in a first direction,

a first of the two supports is rigid and a second of the two supports allows movement in a second direction orthogonal to the first direction; and

the string is caused to vibrate in a plane, which includes the first and second directions, by the stream of fluid medium flowing in a direction having a component in the second direction.

5. (Original) A method according to claim 1, wherein:

the simulated string is supported between two supports aligned in an x-direction;

a first of the two supports allows movement in a y-direction orthogonal to the x-direction and a second of the two supports does not allow movement;

the string comprises a plurality of discrete elements aligned at rest in the x-direction and spaced apart by a distance dx; and

the discrete elements are able to move in discrete steps of time dt in the y-direction only.

6. (Original) A method according to claim 5, in which the string comprises a plurality of j discrete elements from j=0 at one end movably supported by the first support to j=x-1 at the opposite end immovably supported by the second support; wherein

j is an integer; and

the stream of fluid medium flows in the x-direction and exerts a pressure on the string between elements j=0 and j=1.

7. (Original) A method according to claim 6, wherein the force $F_{PRES}[n, 0]$ at time n acting on the immovably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$F_{PRES}[n, 0] = P * (y[n, 0] - y[n, 1]) / dx$$

in which:

P denotes the pressure exerted by the stream of fluid medium on the string between the movably supported element j=0 and adjacent element j=0;

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

y[n, 1] denotes the excursion of the adjacent element j=1 at time n.

8. (Original) A method according to claim 6, wherein the force $F_{TURB}[n, 0]$ at time n acting on the immovably supported element j=0 due to the turbulence in the stream of fluid medium is given by:

$F_{TURB}[n, 0] = C_{TURB} * N_{RND}[n]$

in which:

C_{TURB} denotes a turbulence coefficient; and

$N_{RND}[n]$ denotes a random signal.

9. (Original) A method according to claim 8, wherein the random signal comprises a low pass filtered noise.

10. (Original) A method according to claim 6, wherein the excursion y[n+1, 0] of the movably supported element for the next sample due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$y[n+1, 0] = y[n, 0] + (F_{PRES}[n, 0] + F_{TURB}[n, 0]) * dt^2 / M[0]$$

in which:

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

$F_{PRES}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1;

$F_{TURB}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the turbulence in the stream of fluid medium; and

M[0] denotes the mass of the movably supported element j=0.

11. (Original) A method according to claim 10, wherein the excursion y[n+1, 0] is limited.

12. (Original) A method according to claim 6, wherein the stream of the fluid medium exerts a pressure on the string between each of the elements; and

wherein the force F[n, j] at time n acting on each discrete element from j=1 to j=x-2 due to the pressure P is given by:

F[n, j] = P[j] * (y[n, j] – y[n, j-1]) / dx + P[j] * (y[n, j] – y[n, j+1]) / dx.

13. (Currently Amended) A method according to claim 12, wherein the pressure P decreases linearly or exponentially with increasing j.

14. (Original) A method according to claim 5, wherein the wave equation is an approximation of the continuous wave equation

$$M\frac{\partial^2 y}{\partial t^2} \doteq T\frac{\partial^2 y}{\partial x^2} - S\frac{\partial^4 y}{\partial x^4} + L_T\frac{\partial^3 y}{\partial x^2 \partial t} - L_S\frac{\partial^5 y}{\partial x^4 \partial t} - L_V\frac{\partial y}{\partial t} + F(x,t)$$

in which:

F(x, t) denotes an external force at coordinate x on the string at time t;

M denotes mass per length;

S denotes stiffness of the string;

T denotes tension of the string;

Ls denotes a loss associated with the stiffness of the string;

Lt denotes a loss associated with the tension of the string; and

Lv denotes a loss associated with the turbulent flow of the fluid medium.

15. (Original) A method according to claim 14, wherein the approximation of the continuous wave equation is the discrete recursion formula:

y[n+1, j] = (y[n, j-2]·c1 + y[n, j-1]·c2 + y[n, j]·c3 + y[n, j+1]·c2 + y[n, j+2]·c1 + y[n-1, j-2]·c4 + y[n-1, j-1]·c5 + y[n-1, j]·c6 + y[n1, j+1]·c5 + y[n-1, j+2]·c4) / M[j] + 2y[n, j] + F[n, j]/M[j]

in which:

dx = 1;

dt = 1;

y[n, j] denotes the excursion of discrete element j in the y-direction at time n;

y[n+1, j] denotes the excursion of discrete element j in the y-direction at time n+1;

y[n, j+1] denotes the excursion of discrete element j+1 in the y-direction at time n;

M[j] denotes the mass of discrete element j;

F[n, j] denotes an additional external force acting on a discrete element j at time n; and

c1 to c6 are coefficients, which depend on the material parameters of the string and the surrounding media.

16. (Currently Amended) A method according to claim 15, wherein

c1 = -(S + Ls);

c2 = T + 4S + Lt +4Ls;

c3 = -(2T +6S + Lv + 2Lt + 6Ls);

c4 = Ls;

c5 = -(Lt + 4Ls); and

c6 = Lv +2Lt +6Ls.

17. (Currently Amended) A method according to claim 15, wherein the discrete recursion formula is solved for the elements adjacent the respective supports by providing a dummy element at opposite ends of the string so that the excursion y[n+1, -1] of a dummy element adjacent the movably supported element for the next sample is given by:

y[n+1, -1] = y[n+1, 0] - (y[n+1, 1] - y[n+1, 0])

and the excursion y[n+1, x] of a dummy element adjacent the immovably supported element for the next sample is given by:

y[n+1, x] = -y[n+1, x-2].

18. (Cancelled)

19. (Currently Amended) A machine readable medium providing executable computer program instructions which when executed cause a data processing system to perform a method of simulating, in a machine, a string, the method comprising:

simulating a force acting on the string by a stream of a fluid medium flowing in a direction that has a component along a longitudinal axis of the string;

~~using~~ forming a wave equation that relates movement of the string in time to the force acting on the string; and~~,~~

generating a sound based on the movement described in the wave equation~~wherein the force acting on the string simulates a stream of a fluid medium flowing relative to the string~~.

20. (Currently Amended) The machine readable medium ~~A method~~ according to claim 19, wherein:

the simulated string is supported between two supports and is aligned at rest in a first direction between the two supports;

a first of the two supports allows movement in a second direction orthogonal to the first direction and a second of the two supports does not allow movement; and

the string is caused from rest to vibrate in a plane, which includes the first and second directions, by turbulence in the fluid flow causing the stream of fluid medium to exert a pressure on the string in the second direction.

21. (Currently Amended) The machine readable medium ~~A method~~ according to claim 20, wherein:

movement of the string out of alignment with the first direction causes the stream of fluid medium flowing in the first direction to exert ~~a~~ the force on the string in the second direction.

22. (Currently Amended) The machine readable medium ~~A method~~ according to claim 19, wherein:

the simulated string is supported between two supports aligned in a first direction,

a first of the two supports is rigid and a second of the two supports allows movement in a second direction orthogonal to the first direction; and

the string is caused to vibrate in a plane, which includes the first and second directions, by the stream of fluid medium flowing in a direction having a component in the second direction.

23. (Currently Amended) The machine readable medium ~~A method~~ according to claim 19, wherein:

the simulated string is supported between two supports aligned in an x-direction;

a first of the two supports allows movement in a y-direction orthogonal to the x-direction and a second of the two supports does not allow movement;

the string comprises a plurality of discrete elements aligned at rest in the x-direction and spaced apart by a distance dx; and

the discrete elements are able to move in discrete steps of time dt in the y-direction only.

24. (Currently Amended) The machine readable medium ~~A method~~ according to claim 23, in which the string comprises a plurality of j discrete elements from j=0 at one end movably supported by the first support to j=x-1 at the opposite end immovably supported by the second support; wherein

j is an integer; and

the stream of fluid medium flows in the x-direction and exerts a pressure on the string between elements j=0 and j=1.

25. (Currently Amended) The machine readable medium ~~A method~~ according to claim 24, wherein the force $F_{PRES}[n, 0]$ at time n acting on the immovably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$F_{PRES}[n, 0] = P * (y[n, 0] - y[n, 1]) / dx$$

in which:

P denotes the pressure exerted by the stream of fluid medium on the string between the movably supported element j=0 and adjacent element j=0;

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

y[n, 1] denotes the excursion of the adjacent element j=1 at time n.

26. (Currently Amended) The machine readable medium ~~A method~~ according to claim 24, wherein the force $F_{TURB}[n, 0]$ at time n acting on the immovably supported element j=0 due to the turbulence in the stream of fluid medium is given by:

$$F_{TURB}[n, 0] = C_{TURB} * N_{RND}[n]$$

in which:

C_{TURB} denotes a turbulence coefficient; and

$N_{RND}[n]$ denotes a random signal.

27. (Currently Amended) The machine readable medium ~~A method~~ according to claim 24, wherein the excursion y[n+1, 0] of the movably supported element for the next sample due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$y[n+1, 0]= \quad y[n, 0] + (F_{PRES}[n, 0] + F_{TURB}[n, 0])*dt^2 / M[0]$$

in which:

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

$F_{PRES}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1;

$F_{TURB}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the turbulence in the stream of fluid medium; and

M[0] denotes the mass of the movably supported element j=0.

28. (Currently Amended) The machine readable medium ~~A method~~ according to claim 27, wherein the excursion y[n+1, 0] is limited.

29. (Currently Amended) The machine readable medium ~~A method~~ according to claim 24, wherein the stream of the fluid medium exerts a pressure on the string between each of the elements; and

wherein the force F[n, j] at time n acting on each discrete element from j=1 to j=x-2 due to the pressure P is given by:

F[n, j] = P[j] * (y[n, j] – y[n, j-1]) / dx + P[j] * (y[n, j] – y[n, j+1]) / dx.

30. (Currently Amended) The machine readable medium ~~A method~~ according to claim 29, wherein the pressure P decreases linearly or exponentially with increasing j.

31. (Currently Amended) The machine readable medium ~~A method~~ according to claim 23, wherein the wave equation is an approximation of the continuous wave equation

$$M\frac{\partial^2 y}{\partial t^2} = T\frac{\partial^2 y}{\partial x^2} - S\frac{\partial^4 y}{\partial x^4} + L_T\frac{\partial^3 y}{\partial x^2 \partial t} - L_S\frac{\partial^5 y}{\partial x^4 \partial t} - L_V\frac{\partial y}{\partial t} + F(x,t)$$

in which:

F(x, t) denotes an external force at coordinate x on the string at time t;

M denotes mass per length;

S denotes stiffness of the string;

T denotes tension of the string;

Ls denotes a loss associated with the stiffness of the string;

Lt denotes a loss associated with the tension of the string; and

Lv denotes a loss associated with the turbulent flow of the fluid medium.

32. (Currently Amended) The machine readable medium ~~A method~~ according to claim 31, wherein the approximation of the continuous wave equation is the discrete recursion formula:

y[n+1, j] = (y[n, j-2]·c1 + y[n, j-1]·c2 + y[n, j]·c3 + y[n, j+1]·c2 + y[n, j+2]·c1 + y[n-1, j-2]·c4 + y[n-1, j-1]·c5 + y[n-1, j]·c6 + y[n1, j+1]·c5 + y[n-1, j+2]·c4) / M[j] + 2y[n, j] + F[n, j]/M[j]

in which:

$dx = 1$;

$dt = 1$;

y[n, j] denotes the excursion of discrete element j in the y-direction at time n;

y[n+1, j] denotes the excursion of discrete element j in the y-direction at time n+1;

y[n, j+1] denotes the excursion of discrete element j+1 in the y-direction at time n;

M[j] denotes the mass of discrete element j;

F[n, j] denotes an additional external force acting on a discrete element j at time n; and

c1 to c6 are coefficients, which depend on the material parameters of the string and the surrounding media.

33. (Currently Amended) <u>The machine readable medium</u> ~~A method~~ according to claim 32, wherein

$c1 = -(S + Ls)$;

$c2 = T + 4S + Lt + 4Ls$;

$c3 = -(2T + 6S + Lv + 2Lt + 6Ls)$;

$c4 = Ls$;

$c5 = -(Lt + 4Ls)$; and

$c6 = Lv + 2Lt + 6Ls$<u>.</u>

34. (Currently Amended) <u>The machine readable medium</u> ~~A method~~ according to claim 32, wherein the discrete recursion formula is solved for the elements adjacent the respective supports by providing a dummy element at opposite ends of the string so that the excursion y[n+1, -1] of a dummy element adjacent the movably supported element for the next sample is given by:

$$y[n+1, -1] = y[n+1, 0] - (y[n+1, 1] - y[n+1, 0])$$

and the excursion y[n+1, x] of a dummy element adjacent the immovably supported element for the next sample is given by:

$$y[n+1, x] = -y[n+1, x-2].$$

35. (Cancelled)

36. (Currently Amended) An apparatus for simulating, in a machine, a string, the apparatus comprising:

a processing element to simulate a force acting on the string by a stream of a fluid medium flowing in a direction that has a component along a longitudinal axis of the string and ~~using~~ form a wave equation that relates movement of the string in time to the force acting on the string~~,~~;

a sound generating element, coupled to the processing element, to generate a sound based on the movement described in the wave equation; and

a storage device, coupled to the processing element, to store data for simulating the string.

~~wherein the force acting on the string simulates a stream of a fluid medium flowing relative to the string, said apparatus comprising:~~

~~means for storing data for said simulating; and~~

~~means for simulating.~~

37. (Original) An apparatus according to claim 36, wherein:

the simulated string is supported between two supports and is aligned at rest in a first direction between the two supports;

a first of the two supports allows movement in a second direction orthogonal to the first direction and a second of the two supports does not allow movement; and

the string is caused from rest to vibrate in a plane, which includes the first and second directions, by turbulence in the fluid flow causing the stream of fluid medium to exert a pressure on the string in the second direction.

38. (Currently Amended) An apparatus according to claim 37, wherein:

movement of the string out of alignment with the first direction causes the stream of fluid medium flowing in the first direction to exert ~~a~~ the force on the string in the second direction.

39. (Original) An apparatus according to claim 36, wherein:

the simulated string is supported between two supports aligned in a first direction,

a first of the two supports is rigid and a second of the two supports allows movement in a second direction orthogonal to the first direction; and

the string is caused to vibrate in a plane, which includes the first and second directions, by the stream of fluid medium flowing in a direction having a component in the second direction.

40. (Original) An apparatus according to claim 36, wherein:

the simulated string is supported between two supports aligned in an x-direction;

a first of the two supports allows movement in a y-direction orthogonal to the x-direction and a second of the two supports does not allow movement;

the string comprises a plurality of discrete elements aligned at rest in the x-direction and spaced apart by a distance dx; and

the discrete elements are able to move in discrete steps of time dt in the y-direction only.

41. (Original) An apparatus according to claim 40, in which the string comprises a plurality of j discrete elements from j=0 at one end movably supported by the first support to j=x-1 at the opposite end immovably supported by the second support; wherein

j is an integer; and

the stream of fluid medium flows in the x-direction and exerts a pressure on the string between elements j=0 and j=1.

42. (Original) An apparatus according to claim 41, wherein the force $F_{PRES}[n, 0]$ at time n acting on the immovably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$F_{PRES}[n, 0] = P * (y[n, 0] - y[n, 1]) / dx$$

in which:

P denotes the pressure exerted by the stream of fluid medium on the string between the movably supported element j=0 and adjacent element j=0;

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

y[n, 1] denotes the excursion of the adjacent element j=1 at time n.

43. (Original) An apparatus according to claim 41, wherein the force $F_{TURB}[n, 0]$ at time n acting on the immovably supported element j=0 due to the turbulence in the stream of fluid medium is given by:

$$F_{TURB}[n, 0] = C_{TURB} * N_{RND}[n]$$

in which:

C_{TURB} denotes a turbulence coefficient; and

$N_{RND}[n]$ denotes a random signal.

44. (Cancelled).

45. (Original) An apparatus according to claim 41, wherein the excursion y[n+1, 0] of the movably supported element for the next sample due to the pressure on the string between the movably supported element j=0 and adjacent element j=1 is given by:

$$y[n+1, 0]= \quad y[n, 0] + (F_{PRES}[n, 0] + F_{TURB}[n, 0])*dt^2 / M[0]$$

in which:

y[n, 0] denotes the excursion of the movably supported element j=0 at time n; and

$F_{PRES}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the pressure on the string between the movably supported element j=0 and adjacent element j=1;

$F_{TURB}[n, 0]$ denotes the force at time n acting on the movably supported element j=0 due to the turbulence in the stream of fluid medium; and

M[0] denotes the mass of the movably supported element j=0.